

MISCELLANEOUS NOTES

2. Frontal lamina is differently shaped in adult males., posterior peraeon segments not with distinct spines but with crenulate margin., pleon segments armed with spines, telson conical with a pair of large submedian spines. *C. bovina*
3. Frontal margin of cephalon slightly produced., peraeonal segment VII as broad as other peraeonal segments., eyes small not on border of cephalon., endopod of uropod reaching beyond the posterior margin of pleotelson. *C. parva*
4. Frontal lamina quadrangular in shape., margin of cephalon medially produced.
.. .. *C. venusticauda*
5. Margin of cephalon slightly produced., transverse rows of spines along the posterior margin of the peraeon segments., telson with double row of tubercles or spines. .. *C. sulcicauda*
6. Frontal margin of cephalon smooth, angular., frontal lamina narrow pentagonal, very broad at base., posterior margin of the posterior peraeon segments with one to three transverse rows of spines., pleon tuberculate., telson with a series of pairs of tubercles. *C. pleonastica*
7. Frontal margin of cephalon rounded., posterior peraeon segments and the pleon armed with spines., dorsal surface of the telson with two submedian spines followed by two parallel rows of three to four small spines. *C. fluviatilis*
8. Frontal margin of cephalon rounded., posterior margin of the peraeon segments with a single row of spines., telson with double row of elongated tubercles. *C. pustulosa*
9. Frontal lamina widening to middle., one to three transverse rows of spines along the posterior margin of the peraeon segments., pleon not tuberculate., telson grooved with a series of pairs of tubercles or spines .. *C. sulcata*

ACKNOWLEDGEMENTS

We are grateful to Dr. E. G. Silas, Director, Central Marine Fisheries Research Institute for his keen interest and encouragement. Thanks are also due to Mr. M. Kumaran for the material.

K. M. S. AMER HAMSA
P. NAMMALWAR

CENTRAL MARINE FISHERIES
RESEARCH INSTITUTE,
MANDAPAM REGIONAL CENTRE,
MANDAPAM CAMP,
RAMNAD DISTT., TAMIL NADU,
September 3, 1977.

34. SHELL CHARACTERISTICS OF THE SPAT OF THE TWO SPECIES OF OYSTERS, *CRASSOSTREA MADRASENSIS* (PRESTON) AND *C. CUCULLATA* (BORN)

(With two text-figures)

Although a good deal of information is available on the biology of a few Indian oysters (Rao 1974), our knowledge on the morphology, settlement and growth of spat of many species is still insufficient. Settlement and growth of spat of two species are well known: *Crassostrea madrasensis* (Preston) (Hornell 1910; Paul 1942, Rao & Nayar 1956) and *C. gryphoides* Schlotheim (Durve & Bal 1962).

An important aspect of oyster farming is the collection of the spat of the required species on the spat collectors and the removal of alien spat periodically to avoid competition for space and food. The knowledge of the shell characteristics of the spat of oysters will be useful in studying the early life histories and in maintaining spat collectors free from alien spat.

While studying the settlement of *C. madrasensis* in the Mulki estuary (13° 5' N, 74° 46' E), it was observed that the spat settled on the clutch belonged to two morphological variants. The spat collected from the estuary during 1974-1977 by the author and from a typical marine habitat (Menon *et al.* 1977) during 1973-1975 were examined to study the morphological characters. It was found that the spat settled in this region belonged to two species: *Crassostrea madrasensis* and *C. cu-*

cullata. Rao & Nayar (1956) classified the young oysters (*C. madrasensis*) into spat and yearlings (oysterlings) without assigning clear cut morphological categorisation. In the present investigation, the growth stages from the time of settlement to the size attaining maturity are considered spat. The morphological characteristics of the shell of the spat of both species are described below. The structure and shape of the upper valves of spat belonging to different sizes are given in Figs. 1 and 2.

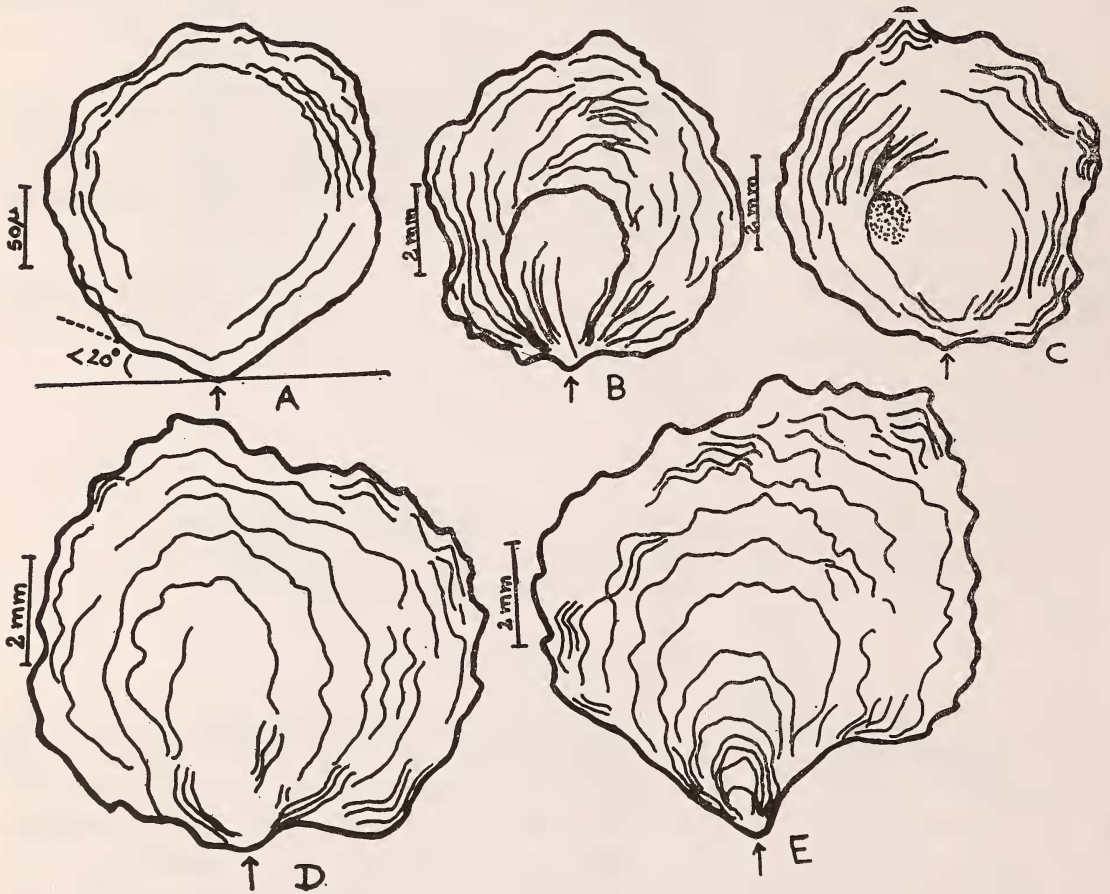


Fig. 1. A - E. Morphological characteristics of the upper valve of the spat of *C. madrasensis*. The nature of the inner phase of the upper valve is shown in A and C. Note the large foliations in marine spat (E).

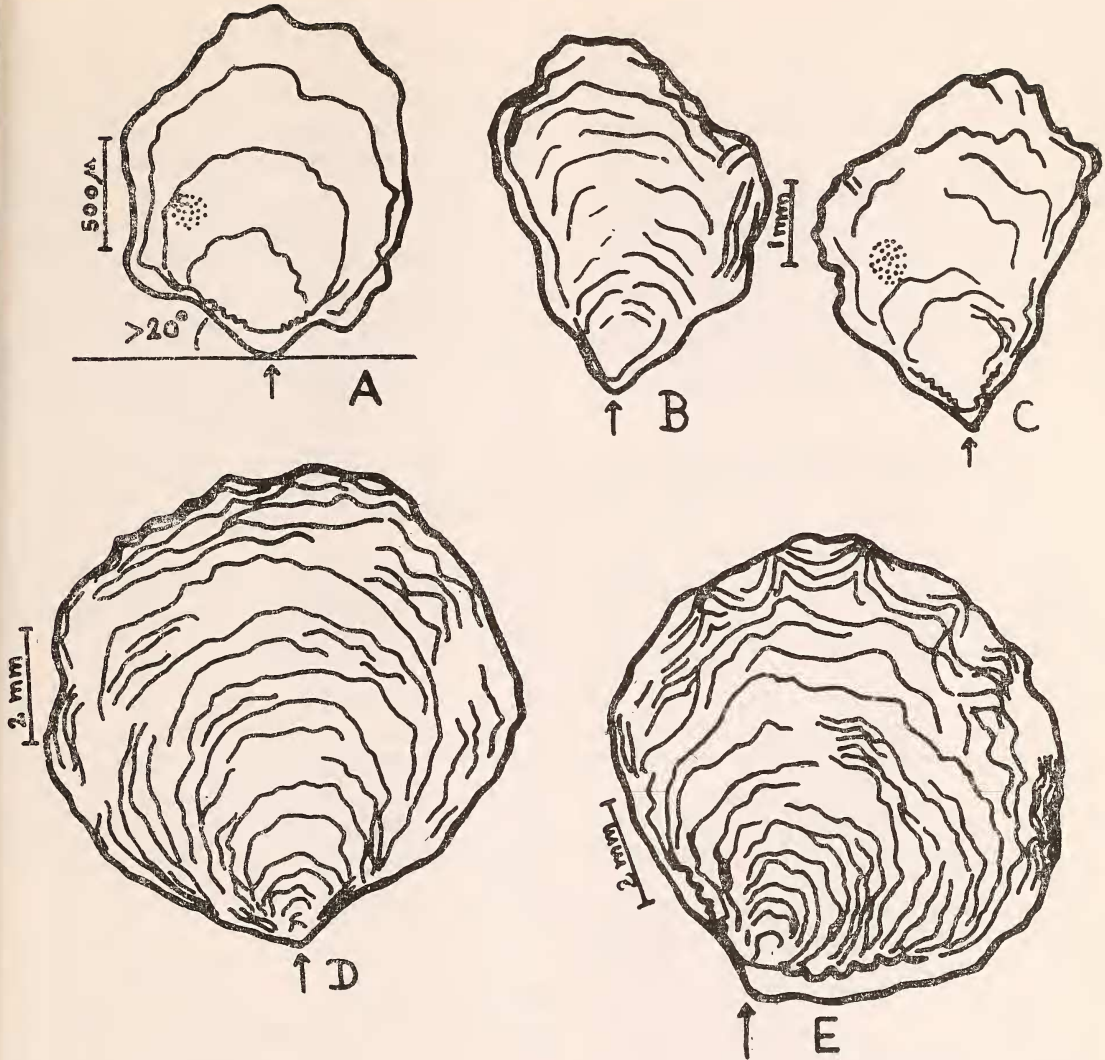


Fig. 2. A - E. Morphological characteristics of the upper valve of the spat of *C. cucullata*. Note the nature of the denticles on the inner phase of the upper valve in A, C and E.

The terms denoting morphological measurements used in the text are those of Rao & Nayar (1956).

The size of the spat of *C. madrasensis* examined ranged from 0.2 mm to 30.0 mm shell height. The lower (left) valve is flat and

adhered to the substratum. The upper (right) valve has an outer convex and an inner concave surface. Both the valves are translucent, brown in colour in spat ranging in size 30 mm shell height and below. The valves are circular in spat of size 20 mm shell height and below,

longer than higher in 21-35 mm shell height, higher than longer in above 35 mm shell height. Generally, the anterior and posterior edges of the valve at the umbo region are at an angle of less than 20 degrees to the base line parallel to the hinge (Fig. 1A). The inner phase of both the valves are smooth and devoid of any denticles at the anterior and posterior margins. The muscle impressions on the upper valve, not very prominent, are placed laterally. The hinge is situated slightly interior to the umbo, forming a small 'beak' underneath.

The size of the spat of *C. cucullata* ranged from 1.0 mm to 25.0 mm in shell height. The lower (left) valve is flat, cemented permanently to the substratum in such a way that it is difficult to remove the lower valve from the substratum. The upper valve has an outer convex and an inner concave phase. Both the

low. Spat larger than 20 mm shell height are higher than longer. Generally, the anterior and posterior margins of the valves at the umbo region are at an angle of more than 20 degrees to the baseline parallel to the hinge (Fig. 2A). The edges of the valves are generally sharp. The muscle impressions on the upper valves are not prominent, laterally placed on the inner phase. Denticles appear on the inner phase along the anterior and posterior margins of the valves at the umbo region in spat of 2 mm shell height. The hinge is situated right at the edge of the valves at the umbo region without forming a 'beak' underneath. A brownish band running from the umbo to the ventral edge is common on the upper valve.

The important shell characteristics which help in easy recognition of the spat of the two species are given in Table 1.

TABLE 1
IMPORTANT MORPHOLOGICAL CHARACTERISTICS OF THE SPAT OF *C. madrasensis* AND *C. cucullata*

<i>C. madrasensis</i>	<i>C. cucullata</i>
Both valves translucent, brown in colour in spat of size upto 30 mm shell height. Larger spat translucent white or brown.	Both valves translucent, pearly white in colour in spat of size upto 20 mm shell height. Larger spat opaque dull white.
Angle formed by the edge of the valve on the baseline parallel to the hinge generally not more than 20°.	Angle more than 20°.
Denticles absent.	Denticles present.
Hinge situated interior to the margin of umbo so as to form a 'beak'.	Hinge situated at the edge. No formation of 'beak'.

valves are translucent, pearly white in colour in spat of size upto 20 mm shell height. The valves attain an opaque dull white colour as growth advances. The valves are circular in outline in spat of 20 mm shell height and be-

I am grateful to Dr. N. R. Menon for the experimental panels from the marine habitat and to Dr. P. S. B. R. James for critical comments.

COLLEGE OF FISHERIES,
UNIVERSITY OF AGRICULTURAL
SCIENCES,
MANGALORE-575 002,
July 26, 1977.

M. MOHAN JOSEPH

MISCELLANEOUS NOTES

REFERENCES

DURVE, V. S. AND BAL, D. V. (1962): Preliminary observations on the growth of spat of the oyster *Crassostrea gryphoides* (Schlotheim). *J. Mar. biol. Ass. India*, 4: 206-213.

HORNELL, J. (1910): Note on an attempt to ascertain the principal determining factor in the oyster spawning in Madras backwaters (Madras Fish. Investigations, 1908). *Madras Fish. Bull.*, 4: 25-31.

MENON, N. R., KATTI, R. J. AND SHETTY, H. P. C. (1977): Biology of marine fouling in Mangalore waters. *Marine Biology*, 41: 127-140.

PAUL, M. D. (1942): Studies on the growth

and breeding of certain sedentary organisms in the Madras harbour. *Proc. Indian Acad. Sci.*, 15B: 1-42.

RAO, K. S. (1974): Mussels and oysters. In: The Commercial Molluscs of India. *Bulletin of the Central Marine Fisheries Research Institute, Cochin, India*, No. 25.

RAO, K. V. AND NAYAR, K. N. (1956): Rate of growth in spat and yearlings of the Indian backwater oyster *Ostrea madrasensis* (Preston). *Indian J. Fish.*, 3: 231-260.

35. *GERANIUM PUSILLUM* L.—A NEW RECORD FROM GARHWAL HIMALAYA

For almost a century this pretty little *Geranium* has been known only from Kashmir, the description in the FLORA OF BRITISH INDIA being based upon a collection of Thomson from Kistawar 8000' (2440 m.). On the basis of this plant, Edgeworth and Hooker f. generalised the distribution as Western temperate Himalaya. Subsequently this species has been known from a few other localities, like Srinagar and Baramula, but all, in Kashmir.

The discovery of this species now, further South-east, in the Garhwal Himalaya, at Brahm Khal, Barkot—4000' (1220 m.), in Uttarkashi district, is of interest and support the original generalised distribution. It is very likely that this species will be found in other parts of the North-western Himalayas and to enable its identification, a detailed description is provided.

Geranium pusillum L., Syst. Nat. ed. 10, 2: 1144, 1759; Edgeworth and Hooker f. in Fl. Brit. Ind. 1: 432, 1875.

Deep-rooted, diffuse, much-branched, annual

herbs, becoming reddish or purple in age. *Branches* prostrate, very slender, pubescent. *Leaves* sparsely glandular, reniform to orbicular, deeply 5-9-lobed or partite; segments cuneate, 3-lobed, mid-lobes long, side-lobes very small; petiole 0.8-2 cm long; stipules short. *Flowers* in axillary peduncles, bluish-purple, small, 6-7 mm in diam.; sepals 5, 2 mm long, glandular-hairy; petals 5, much smaller than the sepals; stamens 10, 5 fertile, c 1 mm long. Fruiting pedicels deflexed. *Fruits* 0.9-1.3 cm long; young carpels hirsute, on maturity smooth; beak slightly hirsute. *Seeds* brown, ellipsoid, minutely granulate, c 1.5 cm long, c 1 mm wide.

Flowering and fruiting—April; common in open grassy slopes. *Arora, C. M.* 37825, Brahm Khal, Barkot, 23rd April 1968 (BSD).

ACKNOWLEDGEMENT

We are grateful to Dr. A. S. Rao, Deputy Director, Northern Circle, Botanical Survey of India, Dehra Dun for guidance.

C. M. ARORA
R. PRASAD

BOTANICAL SURVEY OF INDIA,
NORTHERN CIRCLE,
DEHRA DUN,
February 7, 1977.